



ARTWORK SEPARATION

It is not unusual for art conservators to find evidence of a second painting beneath another artwork. It seems that painters of old, impoverished and unable to afford fresh canvas or wood surfaces, simply painted over a prior work, their own or another's. Thus, when a conservator acquires a new work, he usually has it x-rayed and often this confirms the existence of an underpainting.

However, x-ray photography shows the two works as a blurred double image that usually affords insufficient detail for identifying the subject or the creator of the underpainting. When x-rays show a different but undelineated composition underneath, it's a maddening experience for the museum curator, in whose mind there will always be a question as to whether an unknown masterpiece lies beneath the outer paint.

When William R. Leisher, head of conservation at Los Angeles County Museum of Art (LACMA) examined the

painting above—"The Crucifixion," a 17th century oil on wood by an unknown Flemish painter—he learned from x-rays that there was another painting underneath. He asked Jet Propulsion Laboratory (JPL) for help in delineating the underpainting. Under a grant from California Institute of Technology, JPL and LACMA teamed in an effort that resulted in the first successful use of image enhancement techniques to separate x-ray images of paintings where two or more exist on the same surface. Derived from computer processing of spacecraft-acquired imagery, the technique will allow conservators to better evaluate earlier compositions found beneath paintings.

JPL image-processing specialists developed computer programs for "subtracting" the top painting from the bottom, so that the hidden painting may be seen in more detail. Instructions to the computer minimized the grain pattern of the wood on which the original was painted. Next, a photo of the top painting was matched with the x-ray image; any brushstrokes in the x-ray that coincided with the top painting were



subtracted. Additional subtractions removed much of the top painting. The underpainting, a scene of a man and a woman in 17th century clothing, was then computer-enhanced to bring out detail. An intermediate step in the process is shown above; still visible parts of "The Crucifixion" are shown in dotted lines.

JPL scientists believe that the subtraction technique provides a basis for development of a more advanced system designed especially for discerning and separating multiple x-ray images of paintings. That would be an invaluable tool for conservators and curators. JPL officials also think that computer processing can be adapted to dating paintings on wood by determining the age of the wood. That's done now by a technique that requires shaving away some of the original wood; computer enhancement of the wood grain would eliminate the need for removing material.